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NOTES ON SOME PARASITES AND PREDATORS OF BLACKFLIES (SIMULIIDAE, DIPTERA)

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In view of the economic importance of blackflies as bloodsucking insects affecting animals and man, and the growing recognition of their actual and potential role as vectors of disease, it has been considered of interest to record the following notes concerning certain of their natural enemies, some of which may prove to be of value in developing biological control measures. These observations were made at various times over a period of several years, in connection with a study of blackflies carried out chiefly in the Ottawa district, the results of which have been published elsewhere (13).

PROTOZOA

Several authors have reported parasitic protozoa in the larvae of blackflies. In 1897, Leger (7) described, under the name *Glugea varians*, a new species parasitizing the European *Simulium ornatum* Mgn. Strickland (11, 12), in 1911 and 1913, gave detailed accounts of similar parasites in *S.* (*Prosimulium*) *hirtipes* Fries in the vicinity of Boston, Mass. Edwards (5) in 1921, and Puri (9) in 1925, reported small numbers of *Simulium* larvae similarly affected in England. Cameron (3), in 1922, stated that microsporidia were apparently present in a small percentage of the larvae of *S.* (*Eusimulium*) *bracteatum* Coq. (=*aureum* Fries) and *S. vittatum* Zett. in the vicinity of Saskatoon, Sask.

These parasites occur quite commonly in the larvae of various species of *Simulium* in the Ottawa district, in both Ontario and Quebec, and doubtless are widespread in this region. Infected specimens can be detected readily by the presence in the abdomen of opaque, white masses of the organisms. The abdomens of such specimens are usually distended and the integument often semi-transparent. Usually, too, the histoblasts are very small.

In April, 1934, specimens of infected larvae of *S. venustum* Say and *S. vittatum* Zett. were sent to the late Prof. H. B. Fantham of the Department of Zoology, McGill University. These were collected from several small streams in the Ottawa district in 1926 and 1931 and preserved in about 70 per cent alcohol. Prof. Fantham reported (in litt. Dec. 4, 1931) as follows:

"The *Simulium* larvae are parasitized by a Microsporidian parasite, which I consider to be *Nosema simulii* of Lutz and Splendor, 1908, and the variations to be local races of the same (the chief differences depend on sizes of spores), also the same parasite as that named by Léger in 1897 as *Glugea varians*, allowing for local races. There is considerable confusion between the genera *Nosema* and *Glugea* and other allied genera, and I almost doubt if the cytological and life-history differences cited in the literature are always constant between them. Some later workers, Debaisieux and Gastaldi 1919, have placed the parasite in the genus *Thelohania*. I should be satisfied with the name *Nosema simulii* for the parasite, but taking into consideration the French work of 1919 the name *Thelohania simulii* would be accepted, and by priority the name should be *Thelohania varians* Léger."

Observations in the Ottawa district indicate that the Microsporidian *Thelohania varians* Léger is not specific in its selection of *Simulium* hosts. In addition to *S. venustum* and *S. vittatum*, I have found it in larvae of *S.* (*Pros-*

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imulium) *hirtipes* Fries, *S.* (*P.*) *multidentatum* Twinn, *S.* (*P.*) *gibsoni* Twinn, and *S.* (*Eusimulium*) *mutatum* Mall. Further, I have found infected larvae at various dates from April to September. The percentage of infected larvae was usually rather small, the highest observed being 24.5. This was in specimens of *S. venustum* collected in a small stream at Rockcliffe, Ont., on June 2, 1931. Strickland (11, p. 325) reported that near Boston the percentage varied considerably in different streams, and ranged from less than one up to eighty.

That these Microsporidia exert a degree of natural control on blackflies is indicated by Strickland (11, 12) and Puri (9) who both observed that parasitized larvae failed to pupate.

NEMATODES

In 1911 and 1913, Strickland (11, 12) reported a species of nematode belonging to the genus *Mermis* parasitizing larvae of *Simulium* (*Prosimulium*) *hirtipes* Fries in streams near Boston, Mass. In 1916, Jobbins-Pomeroy (8) recorded *Mermis* parasitizing larvae of *S. venustum* Say in South Carolina, and Edwards (5), in 1921, reported finding them, though rarely, in *Simulium* larvae in Great Britain. Parasitism of blackfly larvae by these nematodes is probably common in Eastern Canada. As recorded elsewhere (13, p. 108), I found them late in April, 1935, in well-grown larvae of *S.* (*P.*) *multidentatum* Twinn which were infesting two small, shallow streams near Hull, Que. The abdomens of the parasitized larvae were distended and the histoblasts undeveloped. The nematodes were visible through the integument, coiled springlike in the abdomen of the host. Of 276 larvae taken at random from one stream, 63, or 22.8 per cent, were parasitized. This closely approximates the largest percentage observed by Strickland, which was 25. Many of the nematodes left the larvae shortly after the latter were removed from the water. The length of the parasites showed considerable variation, but some of them measured more than an inch in length (one was 39 mm.), or three to four times as long as their hosts. Strickland reported that the greatest number of the worms found in a single larva was twelve, but none of these exceeded 10 mm. in length.

The nematodes leave the hosts through the anus or the integument between the abdominal segments, killing them in doing so. The following transcript from my notes is of interest in this connection: "S. C. 31. V. 35—A larva of *S. venustum* Say placed in a shallow dish of water contained a large nematode. Under the low power of the microscope this could be seen probing in search of a way of escape. In a few minutes it forced the anterior part of its body through to the exterior between two of the abdominal segments, entwined itself around a twig in the water and, by means of this anchorage, pulled the fore part of its body from the host. On the twig being removed, it withdrew into the host, but almost immediately again penetrated to the exterior through the region of the anus."

In the two streams referred to, the nematodes were still common in larvae of *S. multidentatum* on May 8, 1935, and in those of *S. venustum* on June 5. However, none was found in *Simulium* larvae examined in these streams on subsequent dates during the summer and early autumn of that year. Jobbins-Pomeroy (8) have reported that *Hydropsyche* larvae attack and feed upon the larvae in South Carolina from May to October. Strickland (12, p. 407) stated that in the vicinity of Boston, Mass., such parasitism was never found in the fall. In the Ottawa district, although the nematodes were conspicuously present only in the spring, occasional specimens were found later in the season. For instance, on July 3, 1935, one was found on a twig taken from the rapids of the Ottawa river and had obviously emerged from the dead and shrunken body of a *Simulium* larva close by. On September 6 of that year, several larvae of *S. vittatum* Zett.,

large in size but with the histoblasts undeveloped, taken from a stream near Breckenridge, Que., were parasitized with nematodes. On gently pressing one of the larvae, a nematode extruded itself through the anus. It differed in colour from the whitish worms found in spring, being of a delicate, pale blue-green shade.

INSECTS

Various forms of aquatic insects, some of which are predatory, occur in parts of rivers and streams in which the immature stages of blackflies develop. Conspicuous among these are the predatory larvae of certain species of caddis flies, the nymphs of stoneflies and, less commonly, the carnivorous larvae of dobson-flies.

Common forms of caddis worms found in such places belong to the genera *Rhyacophila* and *Hydropsyche*. Of these, the former move about freely on the underside of stones and debris in the water until full-grown, when they build shelters of pebbles before pupating, and the latter construct on rocks and stones cup-shaped nets with the openings facing upstream. Howard (6) and Jobbins-Pomeroy (8) have reported that *Hydropsyche* larvae attack and feed upon the larvae of *Simulium*. In streams and rivers in the Ottawa district, I have noted that where caddis worms are abundant, *Simulium* larvae are often sparse or absent, even though from the nature of the water bodies one would expect to find a heavy infestation. Owing to the fast-flowing water and the secretive habits of the caddis larvae, it is difficult to observe their predatory activities. However, on one occasion when a stone was removed suddenly from the water, a caddis worm was seen in the act of seizing a blackfly larva in its mandibles.

As to the part played by mayflies in destroying *Simulium* larvae, Cameron (3) has recorded that mayfly nymphs, among which *Heptagenia* apparently predominated, fed extensively on larvae of *S. simile* (=*arcticum* Mall.) in the waters of the Saskatchewan river, and concluded that they have an important role in reducing the numbers of this species. Stonefly and dragonfly nymphs were also observed freely devouring them.

Certain kinds of winged insects prey upon blackflies. On June 29, 1931, G. H. Fisk, then of the Division of Entomology, noticed, while making observations along a small stream flowing down a wooded hillside, near Hull, Que., that when blackfly larvae were exposed above the water surface they were attacked almost immediately by metallic green flies of the family Dolichopodidae. Specimens captured by Mr. Fisk were determined recently by G. E. Shewell of our service as *Dolichopus splendidulus* Lw., and *Chrysotus* sp. Blackfly larvae may sometimes become exposed for short periods by fluctuations in the water level, and under such circumstances would probably be an easy prey for these and other predacious flies.

Baranov (2) in Studies of *Simulium columbaczense* Schonb., at Golubatz, on the Danube, recorded several species of insects preying on adult blackflies. The most important of these were certain species of flies of the families Asilidae, Empididae, and Anthomyiidae.

Where numerous, dragonflies (Odonata) may destroy many blackflies. F. A. McDougall, Superintendent of Algonquin Park, Ontario, informed me (June 2, 1931) that he had witnessed dragonflies capturing and killing these and other biting flies. When introduced into infested tents in the woods, the dragonflies would feed upon the mosquitoes and blackflies present until thoroughly gorged. Two female specimens of *Simulium venustum* Say collected by H. E. McClure, at Churchill, Man., on July 18, 1936, were labelled "taken from dragonfly" indicating they had fallen prey to one of these insects.

MITES

The larvae of water mites (Hydrachnoidea) are well-known as parasites of acquatic invertebrates. They are frequently found attached to adult mosquitoes, but only once have I found them on blackflies. This was on several adults of both sexes of *Simulium pictipes* Hgn., which emerged from pupae taken from the Mississippi river, at Carleton Place, Ont., on August 6, 1935. On each specimen one or more of these tiny, globular, red mites had attached themselves to the thorax or to the base of the abdomen close to the hind coxae. Numbers of the mites were also found on the blackfly pupae, clinging to the respiratory filaments and to the inside surface of the cocoons. Those on the adults had evidently transferred themselves from the pupae to the flies as the latter emerged from the pupal skins.

FISH

The value of fish as predators on blackfly larvae has been mentioned by several writers. In the United States, Riley (10) recorded that: "many (larvae) are discovered by small fishes belonging to the family Cyprinidae, which frequent even the smallest creeks, and greedily eat them", and Jobbins-Pomeroy (8) noted that "species of minnows attack the larvae frequently". In England, Edwards (5) recorded one case in which large numbers of *Simulium* larvae were found in the stomach of a trout. Cameron (3), in Saskatchewan, concluded that the common sucker, *Catastomus commersonii* is much more important as a natural control factor than any other predatory species. Of specimens of this fish taken from the Saskatchewan river, he stated: ".....the contents of the alimentary canal appeared to consist of nothing else but *simile* (=*arcticum*) larvae and pupae, of which the larvae were much more abundant. The fish were simply gorged with them". Baranov (1) indicated that, in the Danube, the small sturgeon, *Acipenser ruthenis*, feeds almost exclusively on the larvae of *S. columbaczense* Schonb. from March to June and destroys large numbers of them, about 2,000 having been found in one small 10-inch fish.

When visiting Algonquin Park, Ontario, in July, 1936, I was informed by Mr. Robinson, the Assistant Superintendent of the Park, that he had found the stomachs of trout and chub taken from fast-running streams literally gorged with the larvae of blackflies.

Several minnows caught with a net in a small blackfly stream in the Gatineau hills, near Hull, Que., on October 1, 1934, and dissected, contained larvae of *Simulium vittatum* Zett. in their stomachs, as well as other aquatic insects. Extruding from and partly coiled around one of the *Simulium* larvae was a nematode, which apparently was parasitizing the larva when the latter fell victim to the fish. These minnows were identified by Dr. J. R. Dymond, of the Ontario Museum of Zoology, Toronto, as the horned dace or creek chub, *Sematilus atromaculatus*, which is a common and widely distributed species in the streams of Eastern Canada.

FUNGI

The method followed to obtain adult blackflies from pupae is to place the latter on moist cotton in vials closed with cotton plugs. In the course of this work, it was noticed that pupae which had not emerged after a few days were usually dead and often covered with fungus hyphae. Of a collection of a dozen or more pupae of *Simulium nigroparvum* Twinn taken on June 5, 1935, from a sparse infestation in the shallow rapids of the Rideau river, near Ottawa, all but four had died by June 11 and bore a fungus growth. The dead pupae were sent to Dr. H. T. Gussow, Dominion Botanist, who passed them to M. Timonin, of the Division of Botany, for study. Early in September, Mr. Timonin, who had developed cultures of the organism, informed me that the pupae contained fungus growth resembling *Saprolegnia parasitica*, a species parasitic on fish, described by Coker (4) in 1923. On September 13, 1935, I found two

dead and fungus-covered adults of *Simulium vittatum* Zett. embedded in a *Simulium* egg mass on a submerged leaf in a small stream flowing from the Rideau canal into the Rideau river near Ottawa. These were also referred to Mr. Timonin, who reported under date of September 18 that the specimens had developed a growth similar to *S. parasitica.*

A subsequent examination of my notes, made when collecting and rearing blackflies in 1935, revealed several records which may refer to this fungus. These are as follows:

Of a number of pupae of *Simulium* (*Prosimulium*) *hirtipes* Fries taken from a small stream in the Gatineau hills, near Hull, Que., on May 20, two were dead and showing fungus hyphae on May 23.

In a collecion of pupae of *S. corbis* Twinn taken in the Blanche river, south of Perkin's Mills, Que., on May 22, from which adults emerged in confinement, were several that had died and showed the glistening white hyphae of what may have been *Saprolegnia.*

Among a mass of living pupae of *S.* (*Eusimulium*) *lascivum* Twinn taken on May 24 on a dam in the Mississippi river, at Carleton Place, Ont., were several that had died and were covered with fungus hyphae on May 25. On August 6, several pupae of *S. pictipes* Hgn., also collected in this location, were dead on August 10 and had developed a fungus organism, possibly *Saprolegnia.*

Whether in the foregoing instances the fungus had developed as a parasite of the pupae, or merely as a saprophyte nourishing itself upon the decaying tissues of insects already dead was not determined.

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DESCRIPTION OF THE LARVA OF LUDIUS DIVARICATUS LEC.*

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Ludius divaricatus (*Corymbites*) was described in 1853 by LeConte (1). The sexes were described as different species, the female being named *Corymbites crassus.* Blanchard (2) in 1889 pointed out that *crassus* was the female of this species. The writer has examined cast skins of larvae from which both males and females developed and found no characteristic difference between them. The genus *Ludius* contains a large number of species, but only a few larvae have been described or illustrated. Hyslop (3) in his account of wireworms

*Reared specimens were determined by W. S. Fisher, Division of Insect Identification, U. S. Bureau of Entomology and Plant Quarantine.

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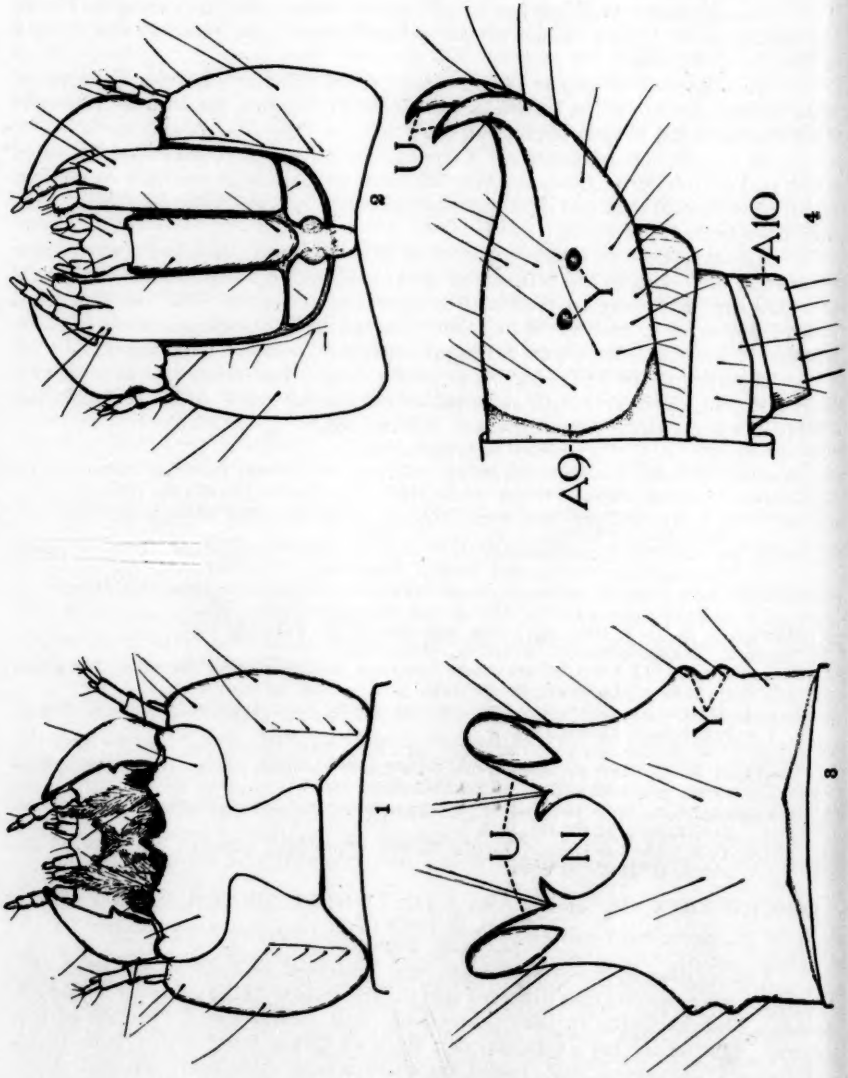
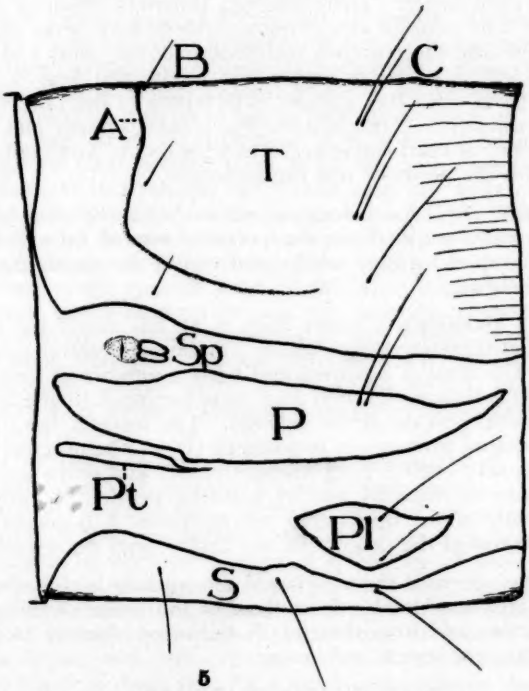
PLATE 17



LARVA OF LUDIUS DIVARICATUS

attacking cereal and forage crops furnishes brief descriptions of *Ludius inflatus* Say and *Ludius pruninus noxious* Hyslop. He also illustrates *L. pruninus noxious*. Hawkins (4) describes and illustrates *Ludius cylindriformis* Hbst. in his bulletin on the bionomics and control of wireworms in Maine. Roberts (5) describes and illustrates a common European species, *Ludius cupreus* F. Glen (6) describes in detail and illustrates the larva of *Ludius aeripennis destructor* Brown.



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The larvae of *Ludius divaricatus* Lec. average 21 mm. in length by 3 mm. across the thorax. The body is very slightly compressed dorso-ventrally and tapers toward the head and ninth abdominal segment. The head and ninth abdominal segment, from a dorsal aspect, are two-thirds to three-fourths as wide as the thorax. The color is light yellowish-brown with the posterior margins of the segments lighter. The medio-dorsal suture and the membranous parts of the cuticle are white. The larvae appear striped on the sides because of the conspicuous membranous areas. The body surface is shiny and nearly smooth.

The head (figs. 1 and 2) is broader than long, darker than the general body color, with the mandibles and anterior part of the frons dark brown. The mandibles are short, rather broad at the base and curved inward. A strong tooth is situated on the inner margin, slightly nearer the base than apex. The nasale is tridentate with the central tooth larger and longer than the other two. The frons is truncate at the base.

The thorax is sparsely punctured. The prothorax is nearly as long as the mesothorax and metathorax combined. The mesothorax is the only thoracic segment that bears spiracles. These are set in small sclerites of the pleura. The spiracles are nearly pyriform, broader in front than behind. There are no im-

pressions on the surface of the tergites similar to those on the abdominal segments. The episterna of the mesothorax and metathorax have from 5 to 9 stout setae on the lower margin.

The surface of abdominal tergites (fig. 5 T) 1 to 8 is smooth with few punctures. A fold or impression (A) on the surface in the anterior region, begins at or near the median suture, extends transversely nearly to the lateral margin and caudad about one-half the length of the segment. The impression forms nearly a right angle. There are two transverse rows of setae on each tergite (B, C.) The anterior row consists of three short setae on each side of the median suture and the posterior row consists of two pairs and a single seta. The paratergite (P) is nearly as long as the tergite and bears a pair of setae. A small narrow paratergite (Pt) appears to be separated from the ventro-cephalic margin of the paratergite. The pleurite (Pl) is subtriangular and in the caudal half of the segment. It bears two setae. The setae on the paratergite and pleurite are on a line with the posterior row on the tergite.

The sternum (S) bears a longitudinal row of three setae on each lateral margin and generally one between the posterior one of these and the medio-ventral line. The spiracles (Sp) are located within the membrane between the tergite and paratergite.

The ninth abdominal segment (figs. 3, 4) has nearly the entire surface slightly rugose and there are two tubercles (Y) on each lateral margin near the dorsal surface. The dorsum is convex and bears a number of long setae on the lateral margins and urogomphi, also four setae arranged in the form of a rectangle on the central portion of the segment. The segment has unusually well developed, cone-shaped processes or urogomphi (U). The urogomphi are nearly as long as the segment itself. They diverge slightly and curve up and forward. Inactive larvae can be lifted by placing a needle within the curved processes. The inner branches of the urogomphi nearly enclose a heart-shaped space or notch (N). The tips of the urogomphi are darker than the segment.

The size and shape of the urogomphi are apparently characteristic for the species. They differ considerably from those of the larvae of the genus *Ludius* noted in the citations and from those of *Ludius atropurpureus* Melsh. of which the writer has examined several specimens.

EXPLANATION OF FIGURES

Fig. 1. Dorsal view of the head of the larva.

Fig. 2. Ventral view of the head of the larva.

Fig. 3. Dorsal view of the ninth abdominal segment showing the arrangement of setae and the size and shape of the urogomphi. U, urogomphi; N, caudal notch; Y, tubercles.

Fig. 4. Lateral view of the ninth and tenth abdominal segments. A-9, ninth abdominal segment; A-10, tenth abdominal segment.

Fig. 5. Lateral view of the sixth abdominal segment of the larva. T, tergite; A, impression on surface of tergite; B, anterior row of setae; C, posterior row of setae; Sp., spiracle; P. large paratergite; Pt, small paratergite; Pl. pleurite; S, sternum.

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PTEROPHORID DESCRIPTIONS AND NOTES (LEPID.) *

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Oidaematophorus occidentalis Wlshm.

In a recent note (1938, Canadian Entomologist, LXX, 128) I suggested that this name should be applied in a strict sense to the species the larva of which feeds on *Aster* and *Grindelia,* but hesitated to separate the *Balsamorrhiza* feeder as a distinct species owing to lack of material; I had, however, called attention (1936. Canadian Entomologist, LXVIII, 63) to certain differences in the setal structure of the pupal cases which warranted further investigation.

The matter has now been satisfactorily cleared up through breeding work done by my assistant in British Columbia, Mr. J. K. Jacob, in the summer of 1938. I have before me a series of moths bred from larvae on a *Balsamorrhiza* sp. (with pupal cases attached) at Osoyoos, B. C. and a longer series from larvae on *Aster conspicuus* from Pavilion Lake, B. C., also with their pupal cases. The structural differences between the two lots of cases are quite obvious and constant and bear out fully my previous notes on the subject. To recapitulate,—the setae of the dorsal and subdorsal verrucae in the *Aster* feeder are much longer (quite strikingly so) than those of the *Balsamorrhiza* feeder; the verruca immediately dorsad of the spiracle bears in the *Aster* feeder one very long seta, directed outward, and a moderately long one, pointing forward, whereas in the other case we find only a single seta of moderate length, directed forward. I am of the opinion that such constant differences warrant the belief that two species are indicated. If, therefore, the name *occidentalis* Wlshm. be applied to the *Aster* feeder, as already suggested, I propose for the other species the following name:

Oidaematophorus balsamorrhizae n. sp.

Palpi light ochreous (at times sprinkled with smoky), rather more slender and shorter than in *occidentalis.* Tufts on fore and mid tibiae somewhat paler and less prominent than in the *Aster* feeder. Forewings light ochreous-fawn, paling to ochreous in the second lobe. A sprinkling of *blackish scales in the costo-basal half of wing,* most prominent along costa, and slightly indicated in the first lobe (this dark scaling is not found in *occidentalis* where the color is entirely tawny-brown of variable intensity). A dark spot at base of cleft, edged outwardly rather faintly with pale creamy; a dark dash on costa obliquely above this spot and edged on both sides by a short cream-colored dash. Fringes concolorous, mixed with light smoky, especially at apices of lobes. Secondaries rather deep smoky with somewhat lighter fringes, becoming quite pale towards base of third lobe. Expanse 23-25 mm.

Holotype— ♂, Osoyoos, B. C., June 18, 1938, (J. K. Jacob); No. 4522 in the Canadian National Collection, Ottawa.

Allotype— ♀, same data.

Paratypes—3 ♂, 4 ♀, same locality and collector, June 13, 19, 20, 21; 2 ♂, 1 ♀, Aspen Grove, B. C., June 7, 9, 1934, (H. B. Leech); 1 ♂, Waterton, Alta., July 18, 1923, (J. McDunnough).

The entire type series bred from *Balsamorrhiza.*

I also have before me a series of captured specimens from the region around Keremeos, B. C. These, due to their less perfect condition, are paler than the type series but still show traces (at least) of the dark sprinkling along costa.

In the male genitalia there are no striking differences from those of *occidentalis;* the rod-like structure (? harpe) of the left clasper seems, however, to be slightly shorter, more curved toward dorsal margin apically and scarcely

*Contribution from the Division of Entomology (Systematic Entomology), Department of Agriculture, Ottawa.

reaching as far towards apex of clasper.

Oidaematophorus albilobata n. sp.

Palpi small, whitish; head grey-brown with a white band between the antennae and white scaling around and beneath the eyes; collar largely white. Thorax grey-brown with an admixture of white scales, the posterior portion and the anterior abdominal segments white, balance of abdomen light grey-brown. Legs light grey-brown, the anterior ones considerably white-scaled. Primaries deep smoky grey with slight sprinkling of white scaling; a broad band of white scaling extends along the inner margin, extending over the entire second lobe and the lower half of the first lobe. A faint dark spot in the cell and another, more distinct, at base of cleft. Costo-apical fringes white, those in cleft deep smoky. Secondaries concolorous with primaries, with smoky fringes. Expanse 25 mm.

Holotype—♂, Cameron Bay, Great Bear Lake, N. W. T., July 9, (T. N. Freeman); No. 4524 in the Canadian National Collection, Ottawa.

The genitalia are very similar to those of *brucei* Fern. showing the same strongly chitinized, produced sacculus, ending in a raised point at about two-thirds the length of clasper, especially strong on the right clasper. The claspers are somewhat shorter and chunkier than in *brucei*, in spite of the relatively larger size of the insect, and the harpe (fig 1) of the left clasper is considerably thinner in its basal portion.

Oidaematophorus thor n. sp.

Palpi quite short and slender, light brown, third joint smoky. Head brown with a pale band between the antennae. Thoracic vestiture grey-brown (as far as can be told). Primaries deep fawn-brown with a few scattered black scales, most prominent along inner margin of second lobe. A few whitish scales along costa, and the lower edge of first lobe rather prominently white-scaled. Costal fringes white; those in cleft and along inner margin of wing deep smoky. Secondaries deep smoky with similarly colored fringes. Beneath deep smoky brown. First two pairs of legs outwardly pale whitish with a thin brown line along femora; inwardly deep smoky; tufting much reduced; hind legs missing. Expanse 22 mm.

Holotype—♂, Estes Park, Colo., July 16, 1936, (G. and J. Sperry); No. 4530 in the Canadian National Collection, Ottawa.

The species is apparently allied to *phoebus* B. & L. of which a paratype is before me. It is, however, very much deeper in the color of primaries and possesses distinctive features in the genitalia (fig. 3) as compared with those of *phoebus* as figured by Lindsey.

Oidaematophorus thoracica n. sp.

Palpi moderate, pale ochreous shaded outwardly on second and third joints with smoky. Head brownish anteriorly and posteriorly, pale creamy between and behind the antennae. Antennae pale creamy, not ringed, with (at times) a small blackish streak at thickened base on inner side. Thorax with anterior portion and patagia, except tips, pale creamy; tips of patagia and *whole middle and posterior section deep purplish black*, the extreme posterior margin with some pale scaling. Abdomen an admixture of pale and dark ochreous scaling, with some slight blackish shading mediodorsally on anterior segments, these dark shades increasing to form a large median blotch about the sixth segment. Legs pale ochreous shaded with brown on underside of first two pairs; tufting quite moderate, brownish. Primaries light ochreous, shaded with pale brownish in costal half of wing, including first lobe; below this darker shading *a strong suffusion of blackish scaling* extends from base of wing to cleft; the usual lunate mark at base of cleft can be faintly observed as a thickening of the dark scaling and there are indications of a dark streak midway between base and

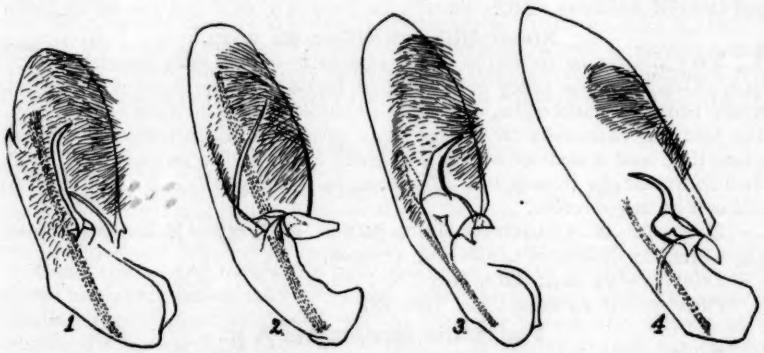
cleft. On costa above cleft a rectangular black spot followed below costa of first lobe by a small dark dot and a narrow dash; a dark dot below apex of lobe and another larger one at inner angle; second lobe with some diffuse dark shading at apex, followed by two minute dark dots along outer margin. Fringes along outer margin of first lobe blackish, paling outwardly, with a paler pencil of hairs opposite lower dark spot; fringes of cleft and of second lobe pale creamy with a dark patch at apex of second lobe. Secondaries smoky brown with paler fringes. Beneath primaries largely smoky, except first lobe which is brownish and repeats the maculation of upper side; secondaries much as above. Expanse 18-20 mm.

Holotype— ♂, Baboquivari Mts., Ariz., April 26, 1938, (G. and J. Sperry); No. 4527 in the Canadian National Collection, Ottawa.

Allotype— ♀, same data, April 24.

Paratypes—1 ♂, 3 ♀, April 23, 24, 26.

With the exception of the holotype the specimens are in poor condition but the characteristic dark thoracic black patch is evident in all, as is the dark shade through centre of forewing. The species appears to be related to *tinctus* Wlshm. which I do not know other than from Lindsey's figures. In genitalia, (fig. 2) however, it is vastly different, in this respect being closest to *helianthi* Wlshm.



Left claspers of 1. *O. albilobata* n. sp.; 2. *O. thoracica* n. sp.; 3. *thor* n. sp. 4; *O. varioides* n. sp.

Oidaematophorus varioides n. sp.

Very close to *varius* B. & L. differing in the somewhat larger size, the lack of dark streaks along the veins, especially in the first lobe, and in some minor points of the male genitalia.

Palpi rather long, projecting well beyond head, whitish. Head, antennae, thorax and abdomen white-scaled, the former with a faint greyish band along the posterior margin. Primaries rather unicolorous pale greyish white; costal edge in basal half (at times) narrowly brownish; faint indication of a smoky spot on second lobe, below base of cleft. Fringes white. Secondaries pale greyish with faintly smoky fringes. Expanse 20-24 mm.

Holotype— ♂, Split Rock Tanks, Mohave Desert, Calif., May 20, 1938. (G. and J. Sperry); No. 4528 in the Canadian National Collection, Ottawa.

Allotype— ♀, same data.

Paratypes—3 ♂, same data; 1 ♂, Ibanpah Mts., Calif., April 29, 1935, (Collection J. A. Comstock); 1 ♂, San Felipe Wash, San Diego Co., Calif., March 5, 1937; 1 ♂, New York Mts., S. Bern. Co., Calif., April 5, 1937, (Collection Andrews and Martin).

In the male genitalia (fig. 4) the harpe of the left clasper is evenly sickle-shaped, the apex pointing to the middle of the ventral margin of clasper, not as in *varius* (see Lindsey's figure) where it is directed toward apex of clasper. In the right clasper the small bar-like harpe shows apically scarcely anything of the strong beak-like projection towards costa found in *varius;* these differences are slight but apparently constant in four specimens of each species examined, including a paratype of *varius.* In this connection it might be well to limit the name *varius* to the San Diego series as there is a possibility the Arizona specimens are not conspecific.

Adaina cinerascens Wlshm.

A single female is before me, bred at Osoyoos, B. C. (June 27, 1938) by J. K. Jacob from a larva on *Balsamorrhiza,* presumably collected along with those of *O. balsamorrhizae;* I incline to place it under the above name although the identity will be doubtful until a male can be secured and the genitalia examined The pupal case is similar in shape to that of *montana* Wlshm. (*declivis* Meyr.) as identified by Lindsey (*vide* Canadian Entomologist, 1935, LXVII, 73). It is, however, very much more thickly covered with secondary short hair, presenting an almost shaggy appearance, and there appear to be more secondary, short setae around the bases of the primary ones; there is further a very broad, black, mediodorsal line but this may not be constant, judging by the variation noted in the pupal cases of *montana.* More material is needed to establish the correct identity.

Stenoptilia grandipuncta n. sp.

Very similar to *columbia* McD. of which it may very possibly be merely a race. Differs in the paler coloration of forewing, due to more white scaling over the brown ground-color, especially in the lobes. *The dark spot at the base of the fissure is extremely large;* there is a prominent dark longitudinal dash in the first lobe and a smaller one at the lower angle of the second lobe, preceded by two short streaks (this is less prominent in the females). A faint dark streak in the cell as in *columbia.*

Holotype— ♂, Churchill, Man., July 3, 1937, (W. J. Brown); No. 4523 in the Canadian National Collection, Ottawa.

Allotype— ♀, same data, July 21.

Paratype—1 ♀, same data, July 22.

Platyptilia immaculata n. sp.

Palpi projecting well beyond front; second joint rough-scaled apically, the scales concealing somewhat the base of the very slender third joint; pale ochreous, tinged faintly with fuscous at apex of second joint. Front and head pale ochreous with well-developed and slightly bifid frontal tuft. Antennae simple, whitish. Thorax creamy white, concolorous with primaries. Abdomen pale ochreous, posterior segments with traces of smoky dorsal and subdorsal lines and slight lateral tuftings which are tipped with fuscous. Legs whitish, the first two pairs deep smoky on inner sides. Primaries light creamy-white, tinged with smoky along costa from base to cleft; a very faint smoky dot below base of cleft on second lobe. Fringes of outer margin of lobes pale, with a minute blackish dot below apex of wing and larger blackish patches at lower angle of first lobe and upper angle of second one; within the cleft the fringes are pale with those of the first lobe tinged in outer half with smoky; at inner angle of second lobe traces of a faint smoky shade; fringes of inner margin white in basal half and smoky in outer portion. Secondaries pale brownish. Fringes distinctly whitish basally and light smoky in outer half; third lobe without dark scale-tufts. Expanse 27 mm.

Holotype— ♂, Argus Mts., Calif., May 14, 1935, (G. and J. Sperry); No. 4529 in the Canadian National Collection, Ottawa.

The genitalia are of the same type as those of *carolina* Kft. The presence of a frontal tuft would remove it from association with the *albiciliata-cooleyi* group and place it closer to *carolina* and *edwardsi.*

A REVISION OF THE AMERICAN SPECIES OF THE GENUS ENARGIA HUBNER (LEPIDOPTERA, PHALAENIDAE, AMPHIPYRINAE)

J. G. FRANCLEMONT,
Cornell University, Ithaca, New York

My original intention was to describe a new species of the genus *Enargia*, but upon doing the genitalia of the "common widespread species", I found that there were in reality two species and not one; Mr. F. H. Wolley Dod came to this same conclusion from a superficial examination of his material in 1905 (Can. Ent., xxxvii, (241-246) and further substantiated his conclusions in 1913 (Can. Ent., xlv, 130). Thus it has seemed adviseable to give the differential characters of these two species as well as those of the new species. Mr. W. H. T. Tams of the British Museum was kind enough to do the genitalia of Walker's type of *decolor* and Grote's type of *infumata*. He found that they represented the two species in question. I wish at this time to express my sincerest thanks to him for his kindness in sending me the photographs of the genitalia of these types and also of Strand's types of *decolor* ab. *sia* and ab. *mia* (ab. 1 and 2 of Hampson, Cat. Lep. Phal. B. M., ix, 239, 1910).

Hubner described the genus *Enargia* in the Verzeichniss bekannter Schmetlinge, 235, 1821, for the single species *paleacea* Esper, which thus automatically became the type of the genus. Guenée in the Annales de la Société Entomologique de France, (1), x, 242, 1841, proposed the name *Euperia* including six species; later in the Species Général Lépidoptères, vi (Noct. ii), 6, 1852, he designated the type as *fulvago* Hubner *nec* Linnaeus, which is *paleacea* Esper. Thus the two generic names are synonyms being isogenotypic. The three North American species discussed here are congeneric in every respect with the type, *paleacea*.

Enargia decolor (Walker)

Mythimna decolor Wlk., Cat. Lep. B. M., xv, 1658, 1859.
Cosmia discolor (sic) Smith, Bull. U. S. N. M. (Cat. Noct.), xliv, 214, 1893.
Enargia decolora Hampson, Cat. Lep. Phal. B. M., ix, 239, 1910.
Enargia decolora ab. *mia* Strand, Arch. Natg., lxxxi, A. Heft 11, 164, 1921.
Enargia decolora ab. *sia* Strand, Arch. Natg., lxxxi, A, Heft 11, 164, 1921.

Head, thorax and fore wings pale luteous yellow to bright ochreous yellow powdered with reddish to dark brownish scales; fore wings with the ante- and postmedial lines distinct and even, red to blackish brown, the former usually acutely angled outwardly a little below middle, the latter curved out to vein 6 then in to inner margin, median shade more or less visible running obliquely from middle of inner margin to lower end of reniform sharply angled at this point and running obliquely to costa to a point above the orbicular, orbicular and reniform evident usually paler than ground ringed by even dark lines of the same color as the ante- and postmedial lines. reniform sometimes stained in lower part by the median shade, but never with a black spot; hind wings pale luteous yellow strongly flushed with crimson and usually crossed by a darker crimson sub-median shade. Underside of fore and hind wings luteous, fore wing crossed by a straight brownish postmedial line, hind wing crossed by an even curved brownish postmedial line, all wings with a brown discal spot.

Genitalia: (fig. 1) Tegumen produced into high shoulders, the uncus moderate and tapering to tip, raised on a rounded process which has a bent lobe on either side; vinculum moderate; valves moderate, rounded at apex, with a double corona extending about 1/3 the length of the ventral margin, clasper stout, curved and spatulate at tip; aedoeagus moderate, with a patch of short recurved spines near the distal end, vesica with two stout bulbed cornuti.

Specimens examined: 69 from New York, Utah, Colorado, Washington, Nova Scotia, Manitoba and British Columbia.

I have not attempted to sort out the two forms described by Strand as the variation in color in this and the following species is almost limitless; I think

PLATE 18

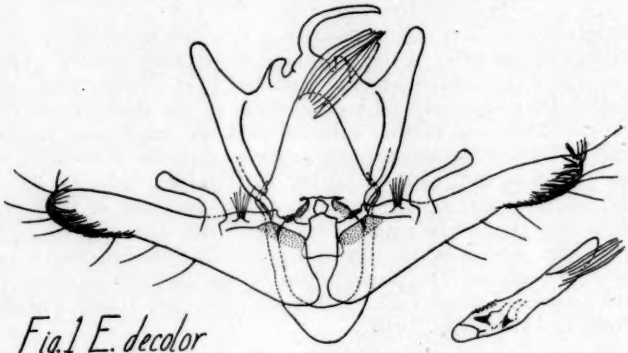


Fig. 1 E. decolor

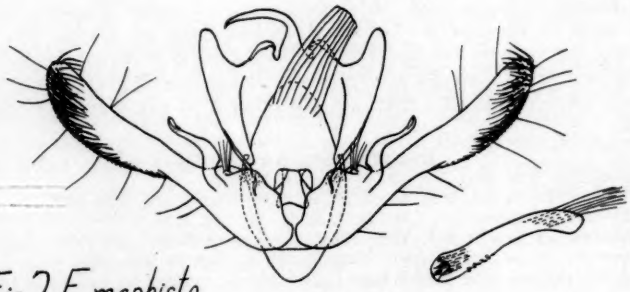


Fig. 2 E. mephisto

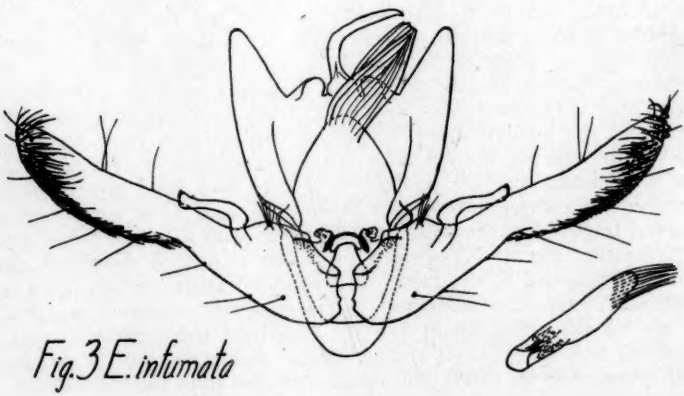


Fig. 3 E. infumata

the names ought to relegated to the synonymy.

Enargia infumata (Grote)

Orthosia infumata Grt., Bull. Buff. Soc. Nat. Sc., ii, 160, 1874.
Cosmia punctirena Smith, Can. Ent., xxxii, 222, 1900.
Enargia decolora (pars) Hampson, Cat. Lep. Phal. B. M., ix, 239, 1910.

Head, thorax and fore wings luteous to bright reddish-ochreous yellow powdered with deep brownish gray in varying degrees of intensity, often so dark as to appear uniform grayish brown but always with a vague hint of the yellow ground color; fore wings with the ante- and postmedial lines distinct and even, reddish brown to black, not too conspicuous in the very dark specimens, the former usually roundly angled outwardly at about middle or slightly below, the latter curving out to about vein 6 then running straight for a short distance then curving inwardly to inner margin, the median shade as in *decolor,* the reniform and orbicular conspicuous of same color as ground, defined by even lines of the same color as the ante- and postmedial lines, the orbicular always with a black spot in lower part, subterminal line pale and biundulate; hind wings whitish to grayish luteous with or without a faint pinkish cast, crossed by vague subterminal and submedian shades. Underside of fore and hind wings pale luteous white more or less powdered with reddish to brownish gray, fore wing crossed by a somewhat curved indefinite reddish brown to black postmedian line, hind wing crossed by a curved reddish brown to black postmedian line, all wings with discal spots.

Genitalia: (fig. 3) Tegumen as in *decolor* but with the shoulders longer, broader and heavier, uncus the same, the two lobes at base not so large; vinculum much as in *decolor;* valves longer and more peaked at apex, with double corona extending more than ½ the length of the ventral margin, clasper not so heavy and not so spatulate at tip; aedoeagus about the same, the two cornuti of the vesica less stout.

Specimens examined: 81 from New York, Utah, Colorado, Washington, Nova Scotia, Manitoba, Alberta and British Columbia.

Superficially the two preceding species differ in the following ways, *decolor* never has a black spot in the lower part of the reniform, the antemedial line is usually more sharply angulate, the hindwing is always more deeply flushed with carmine and the species averages slightly larger; *infumata* always has a black spot in the lower part of the reniform, the antemedial line is usually more-or-less obtusely angulate, the hind wing is only faintly tinted with pink and often this is lacking, the species averages slightly smaller than the preceding. The genitalia of the two species differ most in the length of the corona, it being barely 1/3 the length of the valve in *decolor* and more than ½ the length in *infumata,* also the tegumen of *infumata* is much heavier and bulkier.

Enargia mephisto n. sp.

Head, thorax and fore wings a uniform dusky blackish brown with a powdery appearance, the ante- and postmedial lines obsolescent, barely traceable, antemedial angled outwardly at middle, postmedial convexly curved to vein 6 there sharply angled then evenly curved inwardly to inner margin, reniform and orbicular obsolete, an indistinct blackish point at end of discal cell, no other markings visible or traceable; hind wings pale russet fuscous, fringe concolorous. Underside of wings dusky strawcolor powdered with brown, postmedian line on fore and hind wings vague, brownish and evenly curved, all wings with a brownish discal spot.

Genitalia: (fig. 2) The genitalia of this species resemble most those of *infumata,* but differ in that the shoulders are not so massive and so long, the base of the uncus is heavier and the lobes at its sides are longer; vinculum as in other two species; valves shorter and more rounded at apex, the double corona extending about ½ the length of the ventral margin, clasper about as in *infumata;*

aedoeagus as in the other species, but the cornuti of the vesica are more like those of *decolor*.

Holotype– ♂, Ithaca, New York, July 8, 1937 (J. G. Franclemont), in Coll. Franclemont.

Paratype– ♂, Sardinia, New York, July 5, 1938 (L. R. Rupert), in Coll. Rupert.

This species differs from the two preceding species in its much smaller size, narrower wings, darker coloring, lack of reniform and orbicular, vagueness of the postmedial and antemedial lines, and the fact that it flies about a month before the other two species. The genitalia are most like those of *infumata* from which they differ mainly in their smaller size and less massive construction.

The following key will help to separate the three species,

a. Ante- and postmedial lines obsolescent, reniform and orbicular obsolete ..... *mephisto*

aa. Ante- and postmedial lines evident usually contrasting with ground color; reniform and orbicular distinct, outlined by dark scales.

b. Black spot in lower part of reniform ..... *infumata*

bb. No black spot in reniform, median shade often staining reniform ..... *decolor*

I would arrange the species as follows,

ENARGIA Hbn.
EUPERIA Gn.
decolor *Wlk.*
discolor Sm. *laps. cal.*
sia Strand
mia Strand
mephisto *n. sp.*
infumata *Grt.*
punctirene Sm.

NOTES ON THE APPEARANCE OF THE EUROPEAN EARWIG IN ONTARIO

By A. G. McNally
Department of Entomology, Ontario Agricultural College

In the early part of August, 1938, Professor Caesar, Provincial Entomologist, received from Kenneth C. Hume of Ayton, Ontario, a letter containing insects said to be numerous in that district. Professor Caesar identified these insects as the European earwig, *Forficula auricularia* L. This identification was later confirmed by the Dominion Entomologist from specimens forwarded by Professor Caesar when he reported the outbreak. This is the first recorded outbreak of the species in Canada east of the Rockies.

On August 12th the writer visited Ayton, accompanying Messrs. Pass and Copeland of the Division of Plant Protection, Canadian Department of Agriculture. Our investigations were greatly facilitated by the assistance of Mr. Kenneth Hume who kindly consented to show us about the village. Examination and enquiry indicated that European earwigs were present in practically every home and garden in the main part of the village. In the homes the insects hid during daylight and ventured forth at night, infesting damp clothes and food, although doing no apparent damage to either. In gardens in the village they were found hiding in practically every stalk of corn, in cabbages and lettuce, and in almost every available hiding place. Signs of actual feeding were observed only in cabbages, into the hearts of which numbers had apparently eaten. Several residents reported earlier feeding on the tops of small carrots. Outside of the village earwigs were also found in large numbers both to the east close to the village and to the north about a mile away. In both places they were in corn. None were found in any of the more distant farms examined and reports of

their presence at more distant points were checked and found incorrect.

Attempts to find the date of introduction of the earwigs were disappointing. As many of the residents are of German origin or descent, they were already familiar with the insect in Europe and did not regard its presence here as at all unusual. They said it had been present in numbers for at least three years, and a few had been noticed several years earlier.

Neither could the method of introduction be regarded as at all certain. Interviews failed to indicate any importations of nursery stock, bulbs, or other parcels from infested areas on this continent, or visits of individuals to or from such areas. Apparently only two members of the community had come from Germany in the last twelve years, but it was later learned that eight or nine years ago a number of farm hands had come out from Germany to this district and had made Ayton their headquarters until located on farms, and some had stored their personal effects in the village for several days.

Preliminary control experiments with poisoned bait were made, and while not conclusive, indicated that the formula recommended by the Oregon Agricultural Station, namely, sodium fluoride, twelve ounces; molasses, two quarts; wheat bran, twelve pounds; and water, six quarts; was likely to prove effective. A similar formula in which sodium fluosilicate was substituted for sodium fluoride seemed at least equally as effective. Owing to the lateness of the season and the pressure of other work, further tests in control were postponed until next year.

The writer and Mr. Goble of the Department of Entomology at the Ontario Agricultural College made a brief visit to Ayton on November ninth for the purpose of learning the over-wintering habits of the earwigs. In several places the soil was examined to a depth well below the probable frost line and no earwigs were found, though they had previously been very abundant in these areas. Searches under wood piles and trash and in crevices were also fruitless. Answers to enquiries revealed that earwigs were still present in houses though in markedly diminished numbers. No one had noticed any migration of earwigs from infested fields and gardens to the homes with the advent of cold weather.

EARLY STAGES OF SOME HESPERIINAE

BY V. G. DETHIER
Biological Laboratories, Harvard University

Observations on the life histories of *Polites verna* Edw., *Hesperia leonardus* Harr., and *Ancyloxypha numitor* Fabr. are reported here. Previous work on the rare *P. verna* included a vague description by Scudder of a drawing of the egg and a full account of the last larval instar. Concerning *H. leonardus* only the egg and first instar were known. A drawing of the second instar was also described (Scudder, 1889). In a previous communication (Dethier, 1938) it was pointed out that the third brood of *A. nomitor* probably passed the winter in the larval stage. This is confirmed and further details presented.

Polites verna Edw.

Egg. Bone white. Polygonal cells on the bottom slightly larger than .01 mm. in diameter. Those on the sides and the top of the egg marked with from twenty to twenty-two microscopic punctations. Viewed from the bottom the base is circular and the sides slightly bulging below the equator. Top convex. Height, .60 mm.; greatest diameter, .87 mm.

First Instar. Head width, .5 mm.; head height, .55 to .6 mm. Body length 2 to 2.5 mm. Head shining piceous, faintly corrugate. Few very short transparent hairs. Shield same color as head. Body light cream. Spiracles same color, circumferences light brown. Short scattered hairs on body transparent to light brown. Tubercles from which hairs arise dark brown to black. Two pairs of

equally long hairs on dorsal area of terminal segment. Posterior pair decurved backward; anterior pair recurved forward.

Second Instar. Head width, .6 mm.; head height, .75 to .8 mm. Body length 3 to 4 mm. Head lighter than previous instar, faintly corrugate. Shield same color. Whitish hairs on head more numerous. First pair of legs fuscous. Body mottled with white and gray giving a dead white appearance when viewed with the naked eye. Segments eight and nine whitish due to underlying malpighian tubules. Ventral surface light soiled yellow. Numerous short brown to black spines covering body. Hairs on terminal segment yellowish tipped with brown.

Eggs laid July 25 on grass emerged August 4, ten days having elapsed. The first instar was of nine to thirteen days duration, moults occuring on August 13 and 17.

Hesperia leonardus Harr.

Egg. Agrees with Scudder's description.

First Instar. Head width, .72 to 78 mm.; head height, .73 to .75 mm. Body length 2.5 to 3 mm. Head shiny chestnut with conspicuous scattered punctations. Few minute pale hairs. Body light cream with few scattered testaceous spatulate hairs arranged in rows. One row paradorsal, a subdorsal row, a lateral row, and a substigmatal row. There is one hair to a segment in each row except the substigmatal, where there are two hairs to a segment. Dorsally on the terminal segment are two pairs of rather long curved hairs. At the close of the first instar some larvae are irregularly mottled with maroon and white.

Second Instar. Head width, .90 mm.; head height, .92 mm. Body length 4 to 5.5 mm. Head dark piceous, shallowly punctate. Body light brownish mottled with maroon and white. Microscopic clear circular spots in the maroon areas. Mottling in more or less transverse lines; intersegmental areas free from spots. Hairs on terminal segment relatively short.

These larvae may be distinguished from those of *Catio otho* A. & S. race *egeremet* Scud., with which they might easily be confused, in having distinct spatulate hairs. The hairs in *C. otho* are club-shaped, and the mottling is composed of larger more regular spots of color.

Eggs laid on September 16 emerged September 30, October 5, and October 13, from fourteen to twenty-seven days having elapsed. Although most of the larvae passed the winter in the first instar, some moulted on October 31 and November 4 into the second instar and passed the winter in this stage. The caterpillars fed on various grasses.

Ancyloxypha numitor Fabr.

Indications that the third brood of this species passes the winter in the larval stage have been borne out. A female captured on October 10 oviposited October 13. The first moult occurred October 27; the second, November 15; the third, December 8, 12, and 16; the fourth, December 30. From November 23 on there were severe frosts and generally below freezing temperatures. At this time the larvae were in the third and fourth instars. Out of doors the winter was passed in these stages. In the laboratory, however, the larvae reached the fifth instar before the advent of spring.

When the third instar head capsule is shed, there is visible on the new head the pattern characteristic of the full grown larva. It is white while the head is still green but disappears as the head darkens. In the fourth instar it is indicated as pale light brown streaks in the regions of the future white bands.

LITERATURE CITED

Dethier, V. G., 1938. The Larva and chrysalis of Ancyloxypha numitor Fabr. Bul. So. Calif. Academy Sci., 37 (2): 74-77.

Scudder, S. H., 1889. Butterflies of eastern United States and Canada. Vol. 2.

ENTOMOLOGICAL SOCIETY OF BRITISH COLUMBIA

The thirty-eighth annual meeting of the Entomological Society of British Columbia was held on Saturday, February 25, 1939, at the Hotel Grosvenor, Vancouver, B. C. Twenty-six members were in attendance, and seven new members were elected. The Secretary-Treasurer gave a favourable report as to finances. It was decided to hold future meetings in the fall of the year; the suggested time of meeting is the second Saturday in October, and the next election of officers will be held in October, 1940.

During the evening, an informal dinner was held at the Grosvenor Hotel. Mr. W. Downes spoke on the Insects of New Zealand, and Mr. J. D. Gregson displayed some beautiful examples of coloured photographic projections.

Mr. Ralph Hopping was honoured by being elected Honorary President for the coming year. Other officers elected were as follows:

President—E. P. Venables
Vice-President (Interior)—A. D. Heriot
Vice-President (Coast)—G. J. Spencer
Secretary Treasure—G. R. Hopping
Auditor—J. W. Eastham
Advisory Board—G. J. Spencer, R. Hopping, E. R. Buckell, Allen Mail, R. Glendenning.

The following papers were presented at the meeting:

1. Progress of Pea Moth Control.....R. Glendenning
2. Some Food Plants of Lepidopterous Larvae—List No. 7..J. R. J. Llewellyn-Jones
3. Host Immunity to Ticks.....J. D. Gregson
4. A New Method of Preserving Entomological Specimens in Gelatin.....Harry Andison
5. Brief Note on an Attempt to Hybridize *Notolophus antiqua badia* Hy. Edw. and *Hemerocampa pseudotsugata* McD.....J. R. J. Llewellyn-Jones
6. Note on the Ability of Culicid Larvae and Pupae to Survive in the Absence of Free Atmospheric Oxygen.....G. Allen Mail
7. Some Aspects of Codling Moth Control.....A. D. Heriot
8. British Columbia as a Collecting Ground.....G. J. Spencer
9. A Preliminary Report on an Outbreak of the Soft Scale, *Coccus hesperidum* L. Infesting Holly on Vancouver Island.....Harry Andison
10. Notes on the Ecology of Ticks in Southern Alberta.....Geo. P. Holland
11. On the Life History of *Parasymmictus clausus* O. S. (*Diptera, Nemestrinidae*).....G. J. Spencer
12. The Value of Plant Inspection in Relation to Pest and Disease Control.....H. F. Olds
13. A Note on Insects as Disseminators of Fungus Spores.....C. Curtis
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RESEARCH NOTES

THE CHINCH BUG IN THE MARITIMES

The chinch bug, which has caused injury to grasses in lawns in Nova Scotia and eastern New Brunswick for several years past and which was first identified as *Blissus leucopterus* Say has been determined by G. S. Walley of the Systematic Entomology Unit, Division of Entomology, as another species, *Blissus hirtus* Montandon.

Most injury by this species has occurred in places near the sea, Halifax and Amherst in Nova Scotia, Sackville in New Brunswick. Small infestations found at Fredericton and Woodstock, N. B., and kept under observation for six years, have not developed to cause in these inland places anything like the amount of damage caused on lawns near the sea. Another evidence of the insect's partiality for maritime conditions, or for certain types of grasses which grow well under such conditions, is the fact that the only place it has been found other than in lawns is on the low portions of the Tantramar dykelands at sea level. On these low portions of the marsh land it has been found regularly for five years in association with certain wild grasses.

R. P. Gorham.

PARASITES AND PREDATORS REARED AT QUEBEC

During the past summer several injurious insects were bred in our laboratory at Quebec. They came from various localities in the Province of Quebec. At the same time the following species of parasites and predators were bred and observed at work on the different pests.

Parasites and Predators	Hosts
Meteorus niveitarsis Cress.	bred from *Acrobasis rubrifasciella* Peck.
Hyposoter fugitivus Say	*Malacosoma americana* L.
Hyposoter fugitivus Say	*Hyphantria cunea* Dru.
Hyposoter fugitivus Say	*Schizura concinna* A. & S.
Labrorychus analis Say	*Malacosoma americana* L.
Labrorychus prismaticus Nort.	*Archips cerasivorana* Fitch
Bassus tibiator Prov.	*Metzneria lappella* L.
Macrocentrus cerasivorana Vier.	*Archips cerasivorana* Fitch
Itoplectis conquisitor Say	*Archips cerasivorana* Fitch
Rhyssella nitida Cress.	*Xiphydria canadensis* Prov.
Pammegischia xiphydriae Ashm.	*Xiphydria canadensis* Prov.
Eremotylus macrurus L.	*Telea polyphemus* Cr.
Aenoplex smithii Pack.	*Telea polyphemus* Cr.
Spilocryptus extrematus Cress.	*Telea polyphemus* Cr.
Apanteles militaris Walsh	*Leucania unipuncta* Haw.
Microplectron fuscipennis Zett.	*Diprion polytomum* Htg.
Trogus vulpinus Grav.	*Pieris rapae* L.
Trogus vulpinus Grav.	*Papilio polyxenes asterius* Cr.
Phytomytera leucoptera Johnson	*Archips cerasivorana* Fitch
Winthemia rufopecta Bigot	*Leucania unipuncta* Haw.
Compsilura concinnata Bouche	*Datana ministra* Dru.
Odinia maculata Meig.	*Hyphantria cunea* Dru.
Zenilla blanda O. S.	*Hyphantria cunea* Dru.
Zenilla blanda O. S.	*Anisota rubicunda* Fabr.
Megarhyssa atrata Fabr.	*Tremex columba* Fabr.
Megarhyssa lunator Fabr.	*Tremex columba* Fabr.
Calosoma calidum Fabr.	at work on *Leucania unipuncta* Haw.
Apateticus bracteatus Fitch	*Calligrapha elegans* Ol.
Euchistus euchistoidea Wollenh.	*Pristiphora geniculata* Htg.

J. I. Beaulne.

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